Small Business Innovation Research/Small Business Tech Transfer

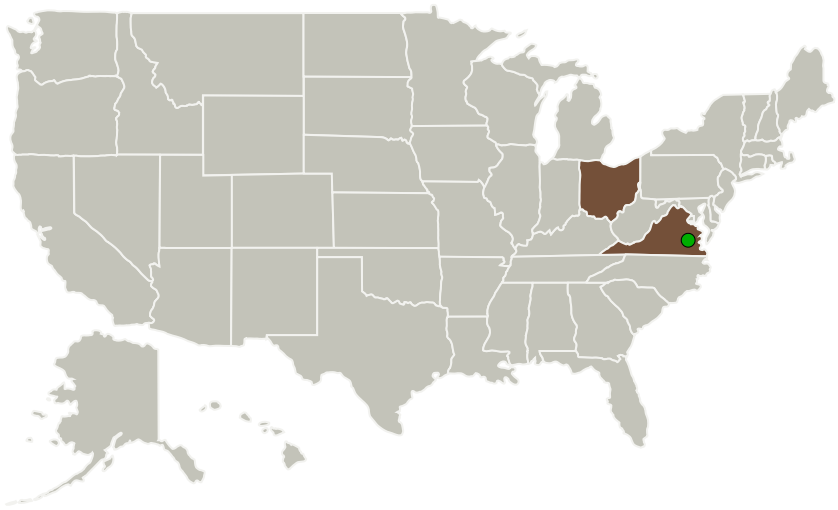
Reclaimable Thermally Reversible Polymers for AM Feedstock, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

Cornerstone Research Group Inc. (CRG) proposes to design and develop thermally-reversible polymeric materials that will function as reprocessable thermosetting matrixes. These material systems will enable reclamation and repurposing of structural fiber-reinforced composites into new configurations during extraterrestrial missions, such as conversion to Additive Manufacturing (AM) feedstocks or direct fabrication into multipart constructs. The thermally-reversible polymer thermosets also present the opportunity to generate volumes of AM feedstock through function as an optimized binder matrix, allowing compounding and impregnation/infusion of in-situ resources such as environmentally sourced metallic, mineralogical (i.e. regolith), and desized/milled non-reprocessable composites. This material approach will provide NASA with a means to generate AM feedstock and support in-situ resource utilization with a reduced reliance on pristine raw material payloads. CRG has already demonstrated the efficacy of thermally-reversible polymer structures in commercial adhesive applications, as well as in a previous NASA technical effort for modifying waste packaging plastics to provide improved compatibility to AM processing (specifically FDM). The proposed concept not only has the potential to enable resource reclamation and AM capability, but also to advance the state-of-the-art in AM materials technology. CRG's proposed approach to develop thermally-reversible polymer materials for thermoset polymer reprocessing, and demonstration of reclamation and AM compatibility evaluation, will provide NASA with a material and processing technology readiness level (TRL) of 3 at the conclusion of the Phase I effort.

Primary U.S. Work Locations and Key Partners



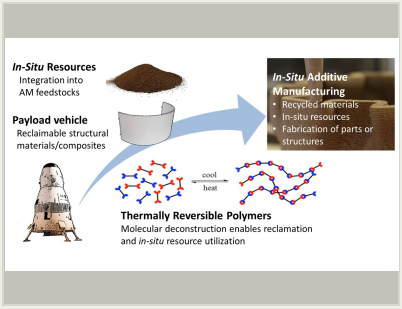


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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Cornerstone Research Group, Inc.	Lead Organization	Industry	Miamisburg, Ohio
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Ohio	Virginia

Project Transitions

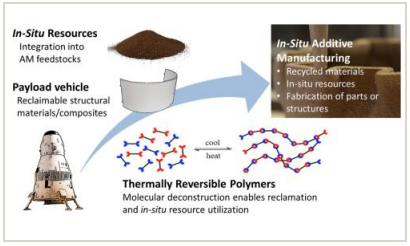
June 2016: Project Start

December 2016: Closed out

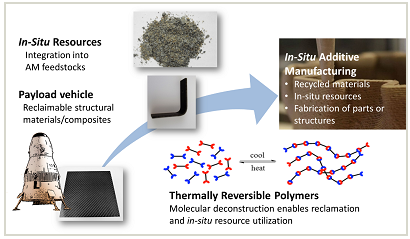
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139667)*

Images



Briefing Chart Image
Reclaimable Thermally Reversible Polymers for AM Feedstock, Phase I *(https://techport.nasa.gov/image/137121)*



Final Summary Chart Image
Reclaimable Thermally Reversible Polymers for AM Feedstock, Phase I Project Image *(https://techport.nasa.gov/image/125773)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Cornerstone Research Group, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

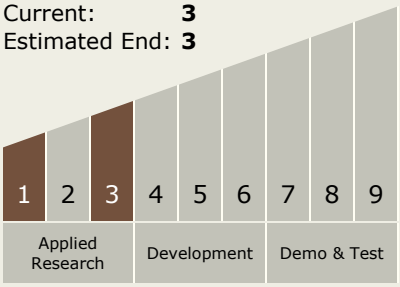
Carlos Torrez

Principal Investigator:

Brian E Henslee

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Reclaimable Thermally Reversible Polymers for AM Feedstock, Phase I

Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System